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(21) International Application Number: PCT/US92/04262 (22) International Filing Date: 20 May 1992 (20.05.92) (30) Priority data: 726,459 8 July 1991 (08.07.91) US (71) Applicant: WARNER-LAMBERT COMPANY [US/US]; 201 Tabor Road, Morris Plains, NJ 07950 (US). (72) Inventors: CHERUKURI, Subraman, Rao ; 10 Jean Drive, Towaco, NJ 07082 (US). CHAU, Tommy, L. ; 3 Dart- mouth - #3A, Bridgewater, NJ 08807 (US). ALLI, Dhan- anjaya ; 61 Maple Avenue, West Orange, NJ 07052 (US). (74) Agents: BELL, Craig, M. et al.; Warner-Lambert Com- pany, 201 Tabor Road, Morris Plains, NJ 07950 (US).		(81) Designated States: BR, CA, JP, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LU, MC, NL, SE). Published <i>Without international search report and to be republished upon receipt of that report.</i>
(54) Title: STABILIZED SWEETENER COMPOSITION (57) Abstract <p>A stabilized dipeptide sweetening composition useful in chewing gum applications provides longer shelf life stability and improved longer lasting sweetness. A dipeptide sweetener such as aspartame is encapsulated through an anhydrous process that compresses the crystals within a mixture of inert binder ingredients so as to form a solid tablet or sheet which is then ground into fine granular particles. These particles may then be coated with a hydrophobic material such as a fat or wax and then incorporated into a variety of food applications such as chewing gum. The sweetener composition is thereby protected from adverse environmental conditions such as high temperature, moisture and pH.</p>		

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Stabilized Sweetener Composition

Related Applications

5 This application is a continuation-in-part of U.S.S.N. 530,769 filed on May 25, 1990.

Field of the Invention

10 The present invention relates generally to the encapsulation of high intensity sweeteners for the purpose of stability in numerous food applications. In particular, it relates to the encapsulation of dipeptide sweeteners such as aspartame that possess greater stability and longer shelf life for use in chewing gum
15 compositions.

Background of the Invention

Whereas the dipeptide sweetener known as aspartame (alpha-L-aspartyl-L-phenylalanine methyl ester) or APM has
20 revolutionized the low calorie food and beverage industries, the sweetener is not without its drawbacks. Of major significance is the sweetener's instability in the presence of heat, moisture and alkaline environments. This instability has prevented its use in most if not all
25 cooking and baking applications and is a factor that must be considered in products that require a long shelf life. Many attempts have been made using different coatings and/or physical/mechanical processing parameters to increase the
30 stability of APM for this purpose and yet there still is much room for improvement.

U.S. Patent No. 4,384,004 to Cea et al discloses the encapsulation of APM with one or a number of different coatings consisting of cellulose, cellulose derivatives,
35 vinyl polymers, gelatin, zein, waxes and mixtures thereof in a ratio of coating material to APM of 1:1 or less. The APM is coated by conducting the APM particles in a stream of air that passes through a zone of atomized liquid droplets of the coating material thereby forming discrete layers about the APM particles under

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substantially anhydrous conditions. The stabilized APM particles are particularly useful in chewing gum applications.

- 5 U.S. Patent Nos. 4,122,195 and 4,139,639 to Bahoshy et al propose to "fix" APM by preparing it with a material such as gum arabic or the reaction product of a compound containing a polyvalent metallic ion, with an ungelatinized
- 10 starch acid-ester of a substituted dicarboxylic acid by a spray-drying technique wherein the APM and film former are prepared in an emulsion. While the technique reportedly shows some improvement in shelf life stability, relatively rapid breakdown of the APM still
- 15 occurs.

- U.S. Patent No. 4,828,857 to Sharma et al discloses a sweetener delivery system wherein the sweetener core material is formed in an agglomerate hydrophobic matrix by spray congealing. The agglomerated matrix is selected
- 20 from the group consisting of waxes, fatty acids and mixtures thereof. The agglomerated sweetener is then given a second coating of these hydrophobic materials and lecithin is added as a wetting agent to increase the affinity of the fat or wax for the APM crystals. Chewing
- 25 gum and boiled hard candy are specifically taught applications for the sweetener delivery system.

- U.S. Patent No. 4,722,845 to Cherukuri et al discloses a stable, cinnamon-flavored chewing gum composition wherein a dipeptide or amino acid sweetener
- 30 is protected from reacting with the degradative aldehydes of the flavor oil by encapsulating the sweetener in a mixture of fat and high melting point (106°) polyethylene wax. The materials are coated onto the aspartame crystals using a modified spray congealing technique to
- 35 form aggregated particles that may be mixed into the gum base for longer lasting shelf life stability.

U.S. Patent No. 4,816,265 also to Cherukuri discloses chewing gum compositions containing APM that is encapsulated with a mixture of a low molecular weight polyvinyl acetate (PVA) and an emulsifier. The

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sweetener is blended into a homogeneous melted molten mass of PVA and the resultant mixture is a semi-solid mass which is cooled to a solid and ground into particles with a U.S. standard mesh size of 30 to about 200. The sweeteners are protected from adverse conditions such as moisture, pH, temperature and reactive chemicals such as flavor oils in the gums.

U.S. Patent No. 4,704,288 to Tsau et al discloses a heat stabilized form of APM for baking applications. Aspartame is first granulated to particles with a U.S. mesh size of from about 8 to about 40 that are then coated with partially dehydrogenated vegetable oil. Both the type of fat and particle size are critical to the stability of the sweetener which may allegedly be used in cakes, cookies and other baked goods.

U.S Patent No. 4,816,265 to Zibell discloses chewing gum with a delayed release, high potency sweetener such as aspartame. The APM is initially coated with modified cellulose such as hydroxypropyl methyl cellulose. The APM particles are then mixed with a zein solution with a pH of from 11.5 to 12.5. The damp mix is then dried to produce twice coated particles of the high intensity sweetener which allegedly enhance the shelf life stability of the sweetener and produce a delayed release of sweetness when this gum is chewed.

PCT Application No. PCT/US88/02398 also to Tsau discloses another heat stabilized form of APM wherein the dipeptide crystals are "spheronized " into dense, non-porous granules of substantially spherical shape within a narrow particle size range. The dense, spherical granules are preferably further encapsulated with a hydrophobic coating such as fats, starches, proteins and/or fibers and allegedly possess both stability against moisture, heat and acidic conditions as well as possessing a sustained release functionality for dispersion of the sweetener throughout the food matrix over time.

U.S. Patent No. 4,588,612 to Perkins et al discloses the compaction of needle-like crystals of a material such

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as aspartame into a plurality of dense chips which are then ground to an average particle size of 20 to 400 standard U.S. mesh. The granules are then spread on a fluid bed spray reactor and encapsulated with a molten hydrogenated lipid or wax. The encapsulated aspartame granules are disclosed as being useful in baking applications since the encapsulating material essentially protects the granule from degradation that would otherwise result from the effects of heat and alkaline pH. The Perkins et al. invention is principally useful with water insoluble coatings which will allegedly protect the APM granules from moisture and heat that is present during baking.

It is an object of the present invention to provide a dipeptide sweetener composition with improved longer lasting shelf life stability. It is a further object of the present invention to provide a stabilized dipeptide sweetener that is compressed and encapsulated with a fat or wax coating in a 1:1 ratio to give it a long lasting shelf life stability. More particularly, it is an object of the present invention to provide an encapsulated compressed APM composition which, through wet granulation technology, possesses a longer lasting shelf life useful in chewing gum compositions where moisture, pH, and reactive flavor oils are adverse degradative factors.

Summary of the Invention

The present invention is an improved dipeptide sweetener with longer lasting shelf life stability that is particularly useful in chewing gum compositions and especially useful in cinnamon-flavored chewing gum. The dipeptide sweetener is encapsulated through a hydrous process that compresses the crystals within a mixture of inert binder ingredients so as to form granules which are then further ground into a fine granular powder (40-60 U.S. Standard mesh). The compressed cores are then coated with a hydrophobic material such as either fat or wax resulting in a dipeptide sweetener with improved

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shelf life stability in the presence of otherwise adverse flavor oils and high processing temperatures.

5 **Brief Description of the Drawings**

Figure 1. is a Differential Scanning Calorimetry profile of APM core materials of the present invention.

Figure 2. is a graph displaying the shelf life stability of the encapsulated aspartame compositions of the present invention in cinnamon gum as a function of
10 percent APM remaining over time.

Detailed Description of the Invention

The dipeptide sweetener compositions of the present invention are stabilized by a process that imbeds the
15 needle-like, dendritic crystals of aspartame into a hydrous mixture of inert elements that further stabilize the sweetener from the adverse affects of temperature, moisture and reactive chemicals. Whereas the use of coatings such as fat, waxes, cellulose etc. have been
20 used extensively in the past in an effort to protect materials such as aspartame from adverse conditions, the dendritic, needle-like shape of the crystals are highly irregular and difficult to impossible to coat in a complete and uniform manner. Moreover, even if the
25 crystals were coated in their entirety, mechanical stresses and/or forces would inevitably break them off leading to exposed and unprotected APM at numerous places which is unsatisfactory.

The compositions of the present invention are
30 comprised of a dipeptide sweetener such as aspartame, alitame and others. The sweetener is first combined in a hydrous mixture or blend of a number of inert compounds which serve in a protective and binding capacity.

The amount of dipeptide sweetener used can vary
35 depending upon the type of food application that it is used in and the degree of sweetness desired. The sweetener can comprise anywhere from 5-70% by weight of the core material, preferably 15-45% and most preferably 20-40% of the total weight of the core material. A binder component selected from the group consisting of gums,

pectins, alginates, mucilages, microcrystalline cellulose and mixtures thereof may be employed. Specifically, the hydrocolloid may comprise gum arabic, tragacanth, karaya, ghatti, agar, alginates, carrageenans, fucellan, psyllium, polyvinyl pyrrolidone, gelatin, dextran, xanthan, curdan, cellulose, methylcellulose, ethylcellulose, hydroxyethyl methylcellulose, carboxymethyl cellulose, low methoxy pectin, propylene glycol alginate, polydextrose, modified starch, maltodextrin and mixtures thereof. The binder is the major component of the core blend and can comprise anywhere from about 10% to about 50% by weight of the core and preferably 15%-45% and most preferably 20% to 40% of the total weight of the core material. This acts not only as a binder but produces protective functionality for the APM as a heat stabilizer.

An inert material such as polyols, carbohydrates or calcium phosphates may optionally be added in a protective capacity to prevent the core sweetener material from reacting with certain constituents of the flavor oils and other chemicals. Cinnamon for example, contains aldehyde groups which react with the dipeptide and result in a loss of sweetness. Polyols suitable in the practice of the present invention include sorbitol, mannitol, xylitol or erythritol and are added in order to stabilize the dipeptide from the adverse conditions of heat, moisture and flavor oils. Mannitol is the polyol most preferred in the practice of the present invention. The polyols may be added to the hydrous blend in amounts from about 5.0% - 80.0%, preferably 10% - 50% and most preferably, 20% to 40% by weight is added to the blend. Carbohydrates such as polydextrose and palatinit as well as mono-, di- and tri-calcium phosphate may also optionally serve as suitable inert protective materials.

The wet granulated APM granules may then be coated with a fat such as animal fat, vegetable fat, waxes, cellulose, or mixtures thereof. This is readily achievable despite the non-uniformity of the particle size shape. Preferably, the particles are coated with a

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mixture of partially hydrogenated soybean oil and glycerol monostearate. Whereas the soybean oil may consist of from about 60% to about 99% and most preferably of from about 90% to about 98% by weight of the entire coating composition, the glycerol monostearate may be incorporated in amounts of from about 0.5% to about 80% and preferably of from about 0.5% to about 20%.

The coating process may be carried out using a standard fluidized bed coating apparatus such as the Verse Glatt Fluid Bed Agglomerator/Dryer Model GPCG-1 (Glatt Air Techniques, Inc., Ramsey, N.J.). The compressed APM particle cores are suspended in an air stream and sprayed with the molten fat composition that is passed through a compressed air nozzle as atomized particles and gradually coats the APM cores. The amount of coating applied to the core is preferably no more than a 1:1 APM core/fat ratio and may be applied as discrete layers during the fluidization process.

Whereas the encapsulated dipeptide sweetener may be used in many applications where long shelf life is a consideration and conditions such as reactive flavor ingredients, temperature, moisture and pH of the food matrix present a hostile or degradative environment, the present inventions is particularly useful in the incorporation in chewing gum and most particularly, cinnamon chewing gums wherein aldehyde components of the flavor oil react with the dipeptide sweeteners causing diketopiperazine formation. However, as Figure 1 clearly shows, the APM granules of the present invention are also stable in the presence of high temperatures. The absence of any peaks in the Differential Scanning Calorimetry (DSC) Profile is indicative of no phase changes occurring in the APM granules even when heated to 100°C. The small peak in the DSC curve that appears near 60° is merely due to some melting of the fat coating caused by the increased temperatures. The surprising and unexpected stability at these high temperatures make the granules of the present invention suitable for baking applications as well.

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With regard to the chewing gum formulations in which the novel delivery system is employed, the amount of gum base will vary greatly depending on various factors such as the type of base used, consistency desired and other components used to make the final product. In general, amounts of about 5% to about 45% by weight of the final chewing gum composition are acceptable for use in chewing gum compositions with preferred amounts of about 15% to about 25% by weight. The gum base may be any water-insoluble gum base well known in the art. Illustrative examples of suitable polymers in gum bases include both natural and synthetic elastomers and rubbers. For example, those polymers which are suitable in gum bases include, without limitation, substances of vegetable origin such as chicle, jelutong, gutta percha and crown gum. Synthetic elastomers such as butadiene-styrene copolymers, isobutylene-isoprene copolymers, polyethylene, polyisobutylene and polyvinylacetate and mixtures thereof, are particularly useful.

The gum base composition may contain elastomer solvents to aid in softening the rubber component. Such elastomer solvents may comprise methyl, glycerol or pentaerythritol esters of rosins or modified rosins, such as hydrogenated, dimerized or polymerized rosins or mixtures thereof. Examples of elastomer solvents suitable for use herein include the pentaerythritol ester of partially hydrogenated wood rosin, pentaerythritol ester of wood rosin, glycerol ester of wood rosin, glycerol ester of partially dimerized rosin, glycerol ester of polymerized rosin, glycerol ester of tall oil rosin, glycerol ester of wood rosin and partially hydrogenated wood rosin and partially hydrogenated methyl ester of rosin, such as polymers of alpha-pinene or beta-pinene; terpene resins including polyterpene and mixtures thereof. The solvent may be employed in an amount ranging from about 10% to about 75% and preferably about 45% to about 70% by weight to the gum base.

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A variety of traditional ingredients such as plasticizers or softeners such as lanolin, stearic acid, sodium stearate, potassium stearate, glyceryl triacetate, glycerine, natural waxes and petroleum waxes such as polyurethane waxes, paraffin waxes and microcrystalline waxes may also be incorporated into the gum base to obtain a variety of desirable textures and consistency properties. These individual additional materials are generally employed in amounts of up to about 30% by weight and preferably in amounts of from about 3% to about 20% by weight of the final gum base composition.

The chewing gum composition may additionally include the conventional additives of flavoring agents, coloring agents such as titanium dioxide, emulsifiers such as lecithin and glyceryl monostearate; and additional fillers such as hydroxide, alumina, aluminum silicates, calcium carbonate, and talc and combinations thereof. These fillers may also be used in the gum base in various amounts. Preferably the amount of fillers when used will vary from about 4% to about 30% by weight of the final chewing gum.

In the instance where auxiliary sweeteners are utilized in addition to those in the present delivery system, the present invention contemplates the inclusion of those sweeteners well known in the art, including both natural and artificial sweeteners. Thus, additional sweeteners may be chosen from the following non-limiting list, sugars such as sucrose, glucose (corn syrup), dextrose, invert sugar, fructose and mixtures thereof; saccharine and its various salts such as the sodium or calcium salt; cyclamic acid and its various salts such as the sodium salt; free aspartame, dihydrochalcone compounds, glycyrrhizin; Stevia rebaudiana (Stevioside); and sugar alcohols such as sorbitol, sorbitol syrup, mannitol, xylitol, and the like. Also contemplated as an additional sweetener is the nonfermentable sugar substitute (hydrogenated starch hydrolysate) which is described in U.S. Pat. No. Re. 26,959. Also contemplated is the synthetic sweetener 3,6-dihydro-6-methyl-1,2,

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3-oxathiazin-4-one-2,2-dioxide, particularly the potassium (Acesulfame-K), sodium and calcium salts thereof as described in German Patent No. 2,001,017.7.

5 Suitable flavorings include both natural and artificial flavors, and mints such as peppermint, menthol, artificial vanilla, cinnamon, various fruit flavors, both individual and mixed, and the like are contemplated. Preferably the cinnamon is used and the
10 flavorings are generally utilized in amounts that will vary depending upon the individual flavor, and may, for example, range in amounts of about 0.5% to about 3% by weight of the final chewing gum composition weight.

 The colorants useful in the chewing gums of the
15 present invention include the pigments such as titanium dioxide and may be incorporated in amounts of up to about 1% by weight, preferably up to about 6% by weight. Also, the colorants may include other dyes suitable for food, drug and cosmetic applications, and known as F.D. &
20 C. dyes and the like. The materials acceptable for the foregoing spectrum of use are preferably water-soluble. Illustrative examples include indigo dye, known as F.D. & C. Blue No. 2, which is the disodium salt of 5.5'-indigotindisulfonic acid. Similarly, the dye known
25 as F.D. & C. Green No. 1, comprises a triphenylmethane dye and is the monosodium salt of 4-[4-N-ethyl-p-sulfobenzylamino)diphenylmethylenel]-[1-(N-ethyl-N-p-sulfoniumbenzyl)-2-5-cyclohexadienimine]. A full recitation of all F.D. & C. dyes and their
30 corresponding chemical structures may be found in the Kirk-Othmer Encyclopedia of Chemical Technology, in Volume 5, at Pages 857-884, which text is accordingly incorporated herein by reference.

 The chewing gums of the invention may be in any form
35 known in the art, such as stick gum, slab gum, chunk gum, shredded gum, hard coated gum, tabletted gum, as well as center-filled gum.

 The process of preparing the inventive chewing gum compositions is as follows. The gum base is melted (about 85° to about 90°C), cooled to 78° C. and placed in

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a pre-warmed (60°C.) standard mixing kettle equipped with sigma blades. The emulsifier is then added and mixed in. Next, a portion of the sorbitol and the glycerin is added and mixed in for an additional 3 to 6 minutes. The mixing kettle is cooled and mannitol and the remainder of the sorbitol and glycerin are then added and mixing is continued. At this time, the unflavored chewing gum temperature is about 39°-42° C. Flavor oil is then added and incorporated into the base and the mixing is continued. Finally, the encapsulated dipeptide sweetener material is added and mixed for an additional 1 to 10 minutes. The encapsulated dipeptide is added as the last ingredient. The final gum temperature is about 39°C to about 43°C. The chewing gum composition is then discharged from the kettle, rolled, scored and formed into chewing gum pieces.

The following examples are provided in an effort to set forth the various aspects of the present invention and to provide further appreciation for its advancement in the art. It is to be remembered that they are for illustrative purposes only and that minor alterations can be made in the types and amounts of materials used or processing parameters applied. They should therefore be regarded as illustrations only and not restrict the spirit and scope of the invention as recited in the claims that follow.

Example 1

The APM particles possessing extended shelf life stability were made as follows. All percentages are based upon a 100% dry weight percent basis. Aspartame (28.3%), mannitol (17.0%), microcrystalline cellulose (17.0%), anhydrous dicalcium phosphate, (17.0%), and gum arabic (9.3%) was placed into a mixing bowl of a three speed mixer (Model C-100, Hobart Co., Troy, Ohio and mixed for 2 minutes at low speed. Additional gum arabic (11.4%) was separately dissolved in water to make a 40% gum arabic solution. The gum arabic solution was slowly blended into the sweetener powder mixture and an

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additional 277 grams of deionized water was added to the mixture to finish the wet granulation process. A wet granular mass was then formed.

5 The wet granular mass was dried in an oven (40-45°C) overnight.

The dried mass was milled in the Pennwalt Stokes Compacting equipment (Model 43-6; Warminster, Penna.) and particles between 30-45 U.S. Standard mesh (590-350
10 micron) were collected and coated.

The particles were then coated using a Glatt GPCG-1 granulator/dryer on a 1:1 particle weight/coating weight ratio with partially hydrogenated soybean oil and glycerol monostearate mixture on a 1:1 particle
15 weight/coating weight ratio.

Example 2

Stabilized aspartame particles were also made utilizing starch instead of mannitol together with gum
20 arabic as the inert binder material.

The aspartame (26.92%), microcrystalline cellulose (17.49%), anhydrous dicalcium phosphate (17.49%), and starch (18.84%) were again placed in a mixing bowl of a three speed blender and mixed for 2 minutes at low speed.
25 A gum arabic solution was made by dissolving the gum arabic (10.36%) into 770 grams of deionized water. Citrus acid (0.24%) was added to the solution as buffer. The gum arabic solution was mixed slowly into the sweetener powder mixture to form a wet granular mass which
30 was then dried in an oven (40-45°C) overnight.

The dried mass was milled in the Pennwalt Stokes Compacting equipment and particles between 30-45 U.S. Standard mesh (590-350 microns) were collected, and coated with partially hydrogenated soybean oil and
35 glycerol monostearate mixture, using a Glatt GPCG-1 Granulator/dryer.

Example 3

Stabilized aspartame particles were made as in

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Examples 1 and 2 with the exception that starch alone was used as the binder material.

Aspartame (26.92%), microcrystalline cellulose (17.49%), dicalcium phosphate (17.49%), and starch were added in the bowl of a three speed mixer and blended for 2 minutes at low speed. A starch solution was made by dissolving starch (18.88%) in 770 grams of deionized water. Both sodium citrate (.18%) and citric acid (.245) were added into the solution as buffer.

Starch solution was then slowly added into the sweetener powder mixture to form a wet granular mass which was dried in an oven (40-45°C) overnight. The dried mass was milled in the Pennwalt Stokes Compacting equipment. Particles between 30-45 U.S. Standard mesh (590-350 microns) were collected and coated with partially hydrogenated soybean oil and glycerol monostearate mixture in a 1:1 particle weight/coating weight mixture.

The aspartame particles from Examples 1-3 were tested for aspartame stability as a function of time by incorporating them into a cinnamon chewing gum. As noted earlier, the aldehyde components of cinnamon mint oils react with and degrade the dipeptide sweetener so as to result in little or no sweetness over relatively short periods of time. Figure 2 shows gum sweetened with aspartame from examples 1-3 as compared with two standard compositions sweetened with aspartame not stabilized by the process of the present invention. One composition covers the aspartame granule with a fat/wax coating at a 3:1 coating APM weight ratio while the other standard comprises aspartame and an elastomer (polyvinyl acetate) coating also at a 3:1 coating/APM weight ratio.

The degree of stability is shown by the percentage of aspartame remaining in the chewing gum samples measured at different intervals over an 18 week period. The amount remaining is a direct correlation with the amount degraded and therefore allows for a comparative analysis of the sweetness stability provided by the

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encapsulated dipeptide sweeteners of the present invention with standard compositions known in the art. Clearly, the aspartame granules made by the wet granulation process of the present invention show
5 significantly greater stability than that of either of the two standard formulations. Even the formulation displaying the least amount of aspartame remaining (aspartame-starch binder alone, #3) had over 20% more
10 aspartame remaining in the same than either of the two standards. This stability translates them into a far greater enhanced sweetness than compositions known in the prior art.

Shelf life stability is not just a function of
15 coating but is increased through physical/chemical changes of the aspartame crystals brought about by inbedding the needle-like dipeptide crystals within naturally stabilizing inert matrix materials. What is
surprisingly unexpected is that this is achieved using a
20 hydrous formulation of binders and inert materials since water usually reacts with and degrades these types of dipeptide sweeteners thereby resulting in a loss of sweetness. Without being bound to any sort of theory, it is thought that the APM becomes sealed thereby
25 prohibiting moisture and other reactive chemicals from invading the spaces that otherwise exist between the dendritic crystals. This sealing prevents degradation by reducing the surface area upon which heat, moisture and other chemicals can react. The milled granules are
30 easier to coat since a uniform layer is far easier to achieve with the compacted, denser crystals. To be effective as protective barriers, coatings must be able to wet and adhere to the crystalline surface which is not generally possible considering the needle-like tips and
35 other spike-like shape variations of pure aspartame powder. The coatings, in addition to being protective barriers, must be flexible enough to conform to the surface irregularities without cracking due to mechanical stresses which occur when the sweetener is incorporated into one of the numerous food applications, chewing gum

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in particular. The dipeptide granule not only facilitates such coating but is self-stabilized to a degree as well.

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What We Claim Is:

1) An encapsulated dipeptide sweetener composition with improved shelf life stability
5 produced
by the process comprising:

10 a) mixing a dipeptide sweetener under hydrous conditions with at least one binding agent, and at least one inert material until substantially discrete wet granules are formed;

15 b) drying said granules until substantially hard;

c) milling the hard sweetener granules to a desired particle size;

20 d) coating said particle cores with a fat or wax material.

25 2) The encapsulated sweetener composition of claim 1 wherein said dipeptide is selected from the group consisting of aspartame, alitame and mixtures thereof.

30 3) The encapsulated sweetener composition of claim 2 wherein said binding agent is a hydrocolloid selected from the group consisting of gum arabic, tragacanth, karaya, ghatti, agar, alginates, carrageenans, fucellan, psyllium, polyvinyl pyrrolidone, gelatin, dextran, xanthan, curdan, cellulose, methylcellulose, ethylcellulose, hydroxyethyl methylcellulose, carboxymethyl
35 cellulose, low methoxy pectin, propylene glycol alginate, polydextrose, modified starch, maltodextrin and mixtures thereof.

4) The encapsulated sweetener composition of claim 3 wherein said inert material is selected from

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the group consisting of polyols, calcium phosphates, microcrystalline cellulose, carbohydrates and mixtures

3 thereof.

5) The encapsulated sweetener composition of claim 4 wherein said polyol is selected from the group

10 consisting of mannitol, xylitol, erythritol, sorbitol and mixtures thereof.

6) The encapsulated sweetener composition of claim 5 wherein said calcium phosphate is selected from

the group consisting of calcium phosphate, dicalcium phosphate, tri-calcium phosphate and mixtures thereof.

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7) The encapsulated sweetener composition of claim 6 wherein said carbohydrate is selected from the

25 group consisting of polydextrose, palatinit and mixtures thereof.

8) The encapsulated sweetener composition of claim 7 wherein said dried sweetener granules range in

30 size from approximately 25 to about 50 U.S. standard mesh.

9) The encapsulated sweetener composition of claim 9 wherein said dipeptide sweetener comprises approximately 5% to about 70% of the particle core, by weight.

10) The encapsulated sweetener composition of claim 9 wherein said dipeptide sweetener comprises

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approximately 20% to about 40% of said particle core
by
weight.

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11) The encapsulated sweetener composition of
claim 11 wherein said binding agent comprises
approximately 10% to about 50% by weight of said
particle core.

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12) The encapsulated sweetener composition of
claim 11 wherein said inert material comprises
approximately 10% to about 50% by weight of said
particle core.

15

13) A chewing gum composition with improved
shelf

life stability and longer lasting sweetness
containing

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the encapsulated dipeptide sweetener composition of
claim 1.

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14) The chewing gum composition of claim 13
further characterized by a flavor selected from the
group consisting of cinnamon, spearmint, peppermint,
fruit or mixtures thereof.

30

15) The chewing gum composition of claim 14
wherein said flavor is cinnamon.

16. A process for the preparation of an
encapsulated dipeptide sweetener composition
consisting

of:

35

a) mixing a dipeptide sweetener under
substantially hydrous conditions with at least
one binding agent, and at least one inert
material;

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b) drying said mixture into substantially hard granules;

5 c) milling said granules into smaller particles; and;

d) coating said particles with a fat, a wax, or mixtures thereof.

10

17. The process of claim 16 wherein said dipeptide is selected from the group consisting of aspartame, alitame and mixtures thereof.

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18. The process of claim 17 wherein said binding agent is a hydrocolloid selected from the group consisting of gum arabic, tragacanth, karaya, ghatti, agar, alginates, carrageenans, fucellan, psyllium, polyvinyl pyrrolidone, gelatin, dextran, xanthan, curdan, cellulose, methylcellulose, ethylcellulose, hydroxyethyl methylcellulose, carboxymethyl cellulose, low methoxy pectin, propylene glycol alginate, polydextrose, modified starch, maltodextrin and mixtures thereof.

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19. The process of claim 18 wherein said inert material is selected from the group consisting of polyols, calcium phosphates, microcrystalline cellulose, carbohydrates and mixtures thereof.

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20. The process of claim 19 wherein said polyol is selected from the group consisting of mannitol, sorbitol, xylitol, erythritol and mixtures thereof.

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21. The process of claim 20 wherein said calcium

phosphate is selected from the group consisting of calcium phosphate, dicalcium phosphate, tri-calcium phosphate and mixtures thereof.

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22. The process of claim 21 wherein said carbohydrate is selected from the group consisting of polydextrose, palatinit and mixtures thereof.

23. The process of claim 22 wherein said milled particles range in size from approximately 25 to about 50 U.S. Standard mesh.

24. The process of claim 23 wherein said dipeptide sweetener comprises approximately 5% to about 70% of the particle core by weight.

25. The process of claim 24 wherein said dipeptide sweetener comprises approximately 20% to about 40% of said particle core by weight.

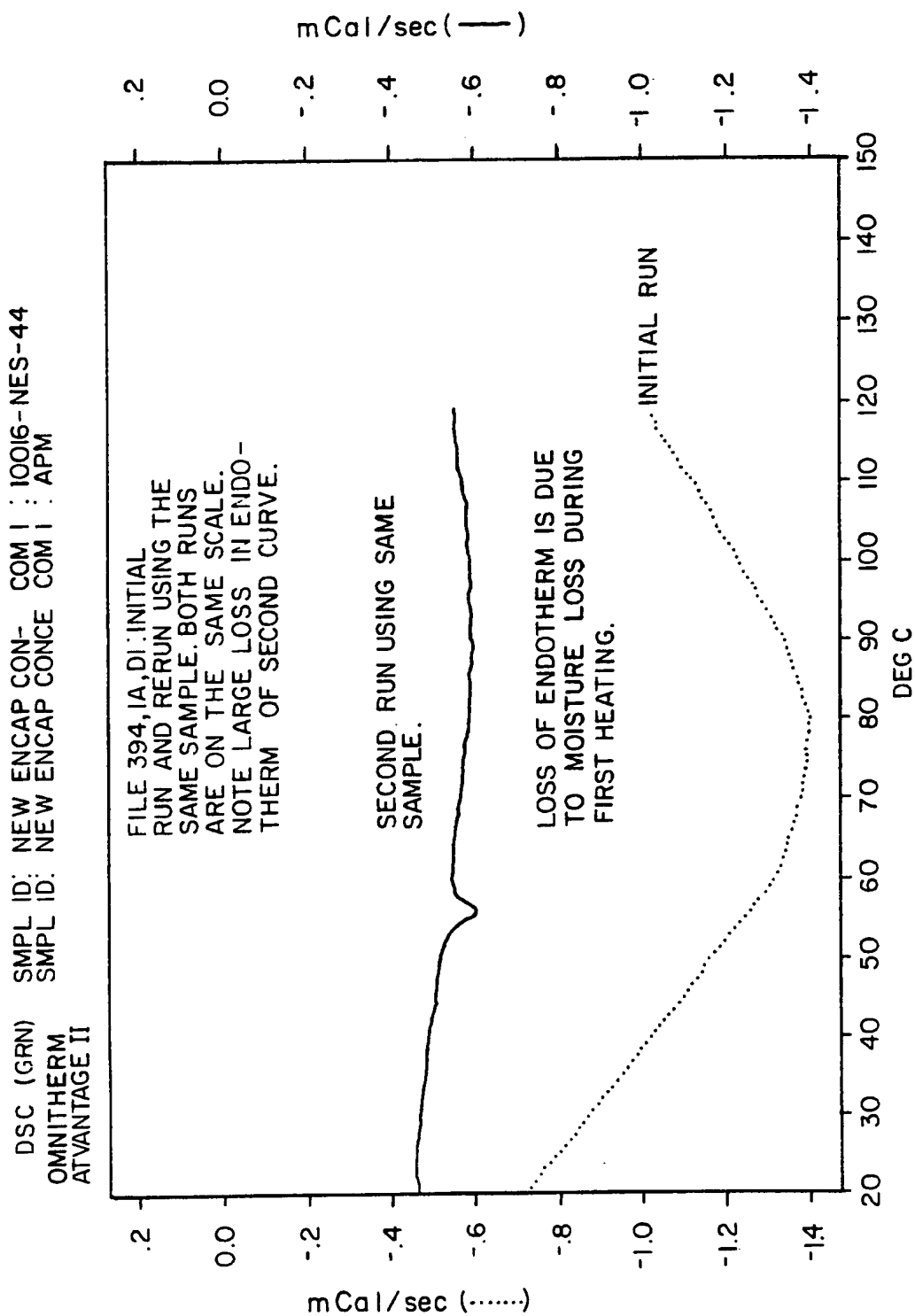
26. The process of claim 25 wherein said binding agent comprises approximately 10% to about 50% by weight of said particle core.

27. The process of claim 26 wherein said polyol comprises approximately 10% to about 50% by weight of said particle core.

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FIG.1



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FIG. 2

NEW ENCAPSULATION CONCEPTS
CINNAMON GUM ASPARTAME STABILITY (30 C)